



## **Pyrolysed carbon microelectrodes with improved performance for cyclic voltammetry and EIS**

**Hassan, Yasmin Mohamed; Gavin, Florence; Caviglia, Claudia; Hemanth, Suhith; Mackenzie, David; Amato, Letizia; Petersen, Dirch Hjorth; Keller, Stephan Sylvest**

*Published in:*  
Book of Abstracts. DTU's Sustain Conference 2015

*Publication date:*  
2015

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Hassan, Y. M., Gavin, F., Caviglia, C., Hemanth, S., Mackenzie, D., Amato, L., Petersen, D. H., & Keller, S. S. (2015). Pyrolysed carbon microelectrodes with improved performance for cyclic voltammetry and EIS. In *Book of Abstracts. DTU's Sustain Conference 2015* [P-8] Technical University of Denmark.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Pyrolysed carbon microelectrodes with improved performance for cyclic voltammetry and EIS

Yasmin M. Hassan\*, Florence Gavin, Claudia Caviglia, Suhith Hemanth, David Mackenzie, Letizia Amato, Dirch H. Petersen, Stephan S. Keller  
DTU Nanotech  
\*yamoh@nanotech.dtu.dk

Conductive carbon structures can be obtained from a polymer template through a pyrolysis process. These structures can be used for example as electrodes or scaffolds. One possible application of the microelectrodes could be integration in a measurement setup with microfluidic and electronic components to study the toxicity of heavy metals and hormones in water. This study focuses on the optimization of 2D pyrolysed carbon microelectrodes obtained from a lithographic process to improve performance for electrochemical characterization (Fig. 1.a). SU-8 was used as photoresist to create the polymer template on a Si-based carrier substrate, and then pyrolysed at 900°C. Different electrodes were fabricated, focusing on the optimization of the fabrication process to decrease impedance, parasitic effects and improve performance in cyclic voltammetry (CV). A gold pseudo-reference electrode and gold contact pads were deposited by e-beam evaporation through a shadow mask, and a 5  $\mu\text{m}$  thick film of SU-8 was used as passivation layer. Electrochemical analysis was performed using CV and impedance spectroscopy both in PBS and in ferri-ferrocyanide using a self-aligning magnetic clamping system (Fig. 1.b). By increasing the carbon thickness, the peak current increased, the  $\Delta E_p$  decreased (Fig. 1.c), and the measured impedance at high frequencies was reduced (Fig. 1.d). The optimal final thickness of the pyrolysed carbon was 2.2  $\mu\text{m}$  with a sheet resistance of 81.1  $\Omega/\text{sq}$ .

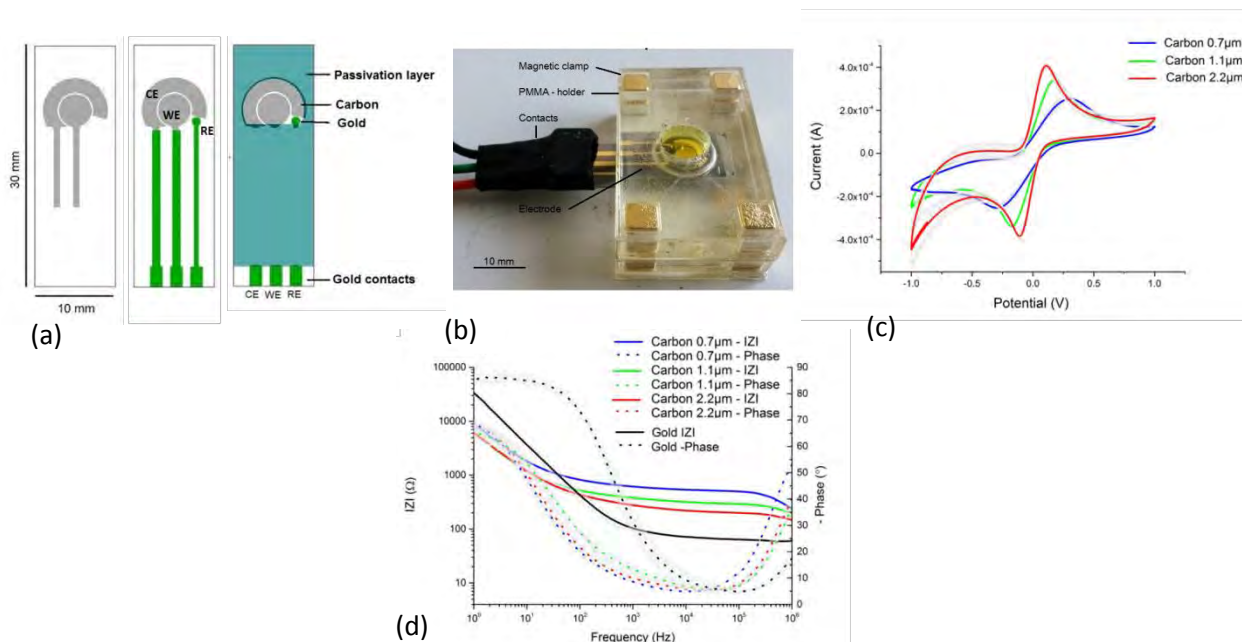


Figure 1: Top view of the microelectrodes composed of a circular carbon working electrode (WE), surrounded by a carbon counter electrode (CE), gold reference (RE), and passivation layer (SU8) (a), self-aligning magnetic clamping system for electrochemical analysis (b), CV spectra in ferri-ferrocyanide (c) and impedance spectra in PBS (d) of the optimized electrode with long gold leads and increased carbon thickness